

FOREST TORTRICIDS TRAPPED USING *EUCOSMA* AND *RHYACIONIA* SYNTHETIC SEX ATTRACTANTS

R. E. STEVENS,¹ C. SARTWELL,² T. W. KOERBER,³ J. A. POWELL,⁴
G. E. DATERMAN,² AND L. L. SOWER²

ABSTRACT. Moths of 31 non-target species of Tortricidae (30 Olethreutinae, 1 Tortricinae) were lured to synthetic *Eucosma* and *Rhyacionia* sex attractants deployed in pine forests throughout 12 states in the western U.S. Genera represented include *Petrova*, *Barbara*, *Phaneta*, *Eucosma*, *Epiblema*, *Epinotia*, *Ancyliis*, *Dichrorampha*, *Sereda*, *Grapholita*, *Cydia*, and *Decodes*, as well as a new genus near *Rhyacionia*.

In 1977 and 1978 we conducted an extensive trapping survey in pine forests in the western United States, using synthetic sex attractants. The primary objective was to learn more about geographical distribution and host relationships of *Eucosma sonomana* Kearfott and species of *Rhyacionia*. While the major results have been published (Sartwell et al., 1980; Stevens et al., 1980), a variety of other moths, largely olethreutines, also responded to the lures. These were saved and identified when their numbers indicated more than chance captures. Generally, a minimum of 4-6 similar moths at a trapping location was considered sufficient to indicate attraction was not incidental, although in some instances we recovered fewer. The catches reported here provide clues regarding pheromone chemistry of and possible taxonomic relationships among certain species. The information may be useful for future studies on these and related species. It also provides range extensions for some of the species captured.

METHODS

Details of the methods, including trapping periods and precise trap locations for most collections, are presented in the previously cited works (Sartwell et al., 1980; Stevens et al., 1980). In cases in which these are not cited, we provide precise trap locations in Table 1. Trapping periods were similar to those at nearby localities. Briefly, we deployed attractant-baited traps in pine forests in most of the western United States in spring and early summer 1977 and 1978. Four baits were used: (E)-9 dodecenyl acetate (referred to hereafter as (E-9)); (Z)-9 dodecenyl acetate (Z-9); a 1:1 mixture of E-9 and Z-9 (50-50); and (E,E)-8,10 dodecadienyl acetate (E,E-8,10).

¹ Rocky Mountain Forest and Range Experiment Station, USDA Forest Service, Fort Collins, Colorado 80526. Headquarters at Fort Collins in cooperation with Colorado State University. Present address: Department of Entomology, Colorado State University, Fort Collins, Colorado 80523.

² Pacific Northwest Forest and Range Experiment Station, USDA Forest Service, Corvallis, Oregon 97331.

³ Pacific Southwest Forest and Range Experiment Station, P. O. Box 245, Berkeley, California 94701.

⁴ Division of Entomology and Parasitology, University of California, Berkeley, California 94720.

The baits were formulated in 3×5 mm cylindrical polyvinyl chloride pellets containing 4% attractant by weight (Daterman, 1974). Baits were mounted on insect pins inserted centrally within Pherocon-II® traps. Traps were hung on tree limbs 1.5–2 m above ground.

Traps were set out at each location in 3 clusters of 5 traps each (4 baited, 1 unbaited), with no trap nearer than ca. 20 m to another. Thus, at each location, each attractant material was presented in 3 traps, along with 3 unbaited traps used as checks. Trapping periods ranged from overnight to more than a month (Stevens et al., 1980). In general, traps were deployed 2 to 8 weeks.

Recovered traps were stored in freezers. Moths were separated by presumed species. Representative individuals were removed with forceps, rinsed in xylene and then hexane or ether to remove the trapping adhesive, and finally relaxed and prepared for identification. In some instances small parts of traps holding specimens or entire traps were immersed in solvent to free specimens.

Representative specimens are kept in the insect museum at Colorado State University, Fort Collins, and at the Essig Museum of Entomology, University of California, Berkeley.

RESULTS AND DISCUSSION

The species trapped, lures responded to, and localities are presented in Table 1. The equivocal nature of a few of the species determinations reflects the difficult taxonomic situation in some Olethreutinae. The unbaited traps captured only occasional stray moths and were not considered attractive.

Altogether, 31 taxa, all but one being Olethreutinae, are represented in the trapped material. Comparing our material with information summarized by Inscoc (1982) and Roelofs and Brown (1982), five genera, *Decodes*, *Ancylis*, *Phaneta*, and *Sereda*, and a new eucosmine near *Rhyacionia*, are not reported to have been previously captured using synthetic attractants.

Most of the trapped Eucosmini responded to Z-9, E-9, and the 1:1 mixture of the two (50:50). *Phaneta columbiana* (Walsingham) was an exception, responding almost exclusively to E,E-8,10. Moths of the new genus near *Rhyacionia* responded to E-9, Z-9, and 50-50 except at Kingman, Ariz., where all 17 specimens were lured to E,E-8,10. This anomaly seems to justify further attention.

In general, members of the Grapholitini were attracted to E,E-8,10. The species of *Cydia* showed some variability in their responses to the preferred materials, reflecting the difficulties in their perceived taxonomic relationships. *C. tana* (Kft.) responded to 50-50, but since a total of only four specimens were collected this may not be meaningful.

However moths of the *C. piperana* complex were lured in large numbers to 50-50, as well as to E-9 and Z-9 (none to E,E-8,10); this may imply some divergence between this complex and other elements of the genus.

The two species of *Grapholita* we collected responded solely to E,E-8,10; more *G. conversana* Walsingham moths were trapped than any other species aside from the target *Rhyacionia*. By contrast, the much-studied oriental fruit moth, *G. molesta* (Busck) appears to respond primarily to compounds unsaturated only at the 8th position in the 12-carbon chain (Inscoc, 1982).

ACKNOWLEDGMENTS

We thank Richard C. Brown for determining *Epinotia* species, and J. W. Brewer and W. E. Miller for helpful suggestions on the manuscript.

LITERATURE CITED

- DATERMAN, G. E. 1974. Synthetic sex pheromone for detection survey of European pine shoot moth. Res. Pap. U.S. Dep. Agric. For. Serv. PNW-180. 12 pp.
- INSCOE, MAY N. 1982. Insect attractants, attractant pheromones, and related compounds. Pp. 201-295, in A. F. Kydonieus & Morton Beroza (eds.). Insect suppression with controlled release pheromone systems. CRC Press, Boca Raton, Florida.
- ROELOFS, WENDELL L. & RICHARD L. BROWN. 1982. Pheromones and evolutionary relationships of Tortricidae. Ann. Rev. Ecol. Syst. 13:395-422.
- SARTWELL, CHARLES, G. E. DATERMAN, T. W. KOERBER, R. E. STEVENS & L. L. SOWER. 1980. Distribution and hosts of *Eucosma sonomana* in the western United States as determined by trapping with synthetic sex attractants. Ann. Entomol. Soc. Amer. 73:254-256.
- STEVENS, ROBERT E., CHARLES SARTWELL, THOMAS W. KOERBER, GARY E. DATERMAN, LONNE L. SOWER & JERRY A. POWELL. 1980. Western *Rhyacionia* (Lepidoptera: Tortricidae, Olethreutinae) pine tip moths trapped using synthetic sex attractants. Can. Entomol. 112:591-603.

TABLE 1. Tortricidae other than *Eucosma sonomana* and *Rhyacionia* spp. trapped with synthetic sex attractants, western United States, 1977 and 1978.

| Species | Attractant(s) and number moths trapped | Localities collected ¹ |
|---|--|---|
| Olethreutinae | | |
| <i>Eucosmini</i> —new genus near <i>Rhyacionia</i> | E-9 (338) | <i>Arizona</i> : Kingman A, Portal |
| | Z-9 (3) | <i>New Mexico</i> : Reserve, Ruidoso, Santa Fe, Silver City |
| | 50-50 (32) | |
| | E,E-8,10 (17) ² | |
| <i>Petrova metallica</i> (Busck) | E-9 (96) | <i>California</i> : Scott Valley (4 km W), Tuolumne Mdws., Yosemite Vil- lage (12 km NW) |
| | Z-9 (16) | |
| | 50-50 (45) | <i>Nebraska</i> : Alliance |
| | E,E-8,10 (6) | <i>Oregon</i> : Burns, Crescent Lake, Grants Pass, Keno, Sisters <i>Washington</i> : Entiat <i>Wyoming</i> : Kemmerer |
| <i>Petrova picicolana</i> (Dyar) | E-9 (27) | <i>California</i> : Old Station (10 km SE), Sierra City (12 km N), Truckee A, Tuolumne Mdws., Yosemite Village (12 km NW) |
| | Z-9 (5) | |
| | 50-50 (255) | <i>Colorado</i> : Fraser |
| | E,E-8,10 (1) | <i>Idaho</i> : Coeur d'Alene, Headquar- ters <i>Montana</i> : East Glacier <i>Oregon</i> : Baker, Crater Lake, Cres- cent Lake, Idanha, Tiller, Sis- ters, Ashland <i>Utah</i> : Vernal <i>Washington</i> : Leavenworth <i>Wyoming</i> : Afton |
| | | <i>Idaho</i> : Headquarters, Coeur d'Alene <i>Nevada</i> : Las Vegas A <i>Oregon</i> : Idanha <i>Washington</i> : Kettle Falls <i>Wyoming</i> : Afton |
| | | <i>Idaho</i> : Arco <i>Nevada</i> : Austin <i>Oregon</i> : Lakeview <i>Utah</i> : Dutch John |
| | | <i>Arizona</i> : Kingman B <i>California</i> : Big Bear City B, Lee Vining (4 km SW) <i>Colorado</i> : Ft. Collins C, Woodland Park <i>Idaho</i> : Arco <i>Montana</i> : Wolf Creek <i>Nevada</i> : Austin, Las Vegas A <i>Utah</i> : Dutch John <i>Wyoming</i> : Kemmerer |
| | | <i>Oregon</i> : Bly, Chiloquin, Bend, Lakeview, Gold Beach, Sisters, |
| | | |
| | | |
| <i>Barbara colfaxiana</i> (Kear- fott) | Z-9 (24) | |
| | | |
| <i>Phaneta columbiana</i> (Walsingham) | Z-9 (1) | |
| | E,E-8,10 (43) | |
| <i>Eucosma bobana</i> Kearfott | E-9 (1) | |
| | Z-9 (343) | |
| | 50-50 (168) | |
| | E,E-8,10 (5) | |
| <i>Eucosma ponderosa</i> Powell | Z-9 (14) | |
| | 50-50 (8) | |

TABLE 1. Continued.

| Species | Attractant(s) and number moths trapped | Localities collected ¹ |
|------------------------------------|--|------------------------------------|
| | E,E-8,10 (2) | O'Brien |
| | | Washington: Entiat, Goldendale |
| <i>Eucosma recissoriana</i> | Z-9 (256) | California: Tioga Pass, Tuolumne |
| complex | 50-50 (127) | Mdws., Yosemite Village (12 km NW) |
| | | Montana: Boulder |
| | | Oregon: Chiloquin, O'Brien |
| | | Utah: Manila |
| | | Wyoming: Buffalo |
| <i>Epiblema resumptana</i> | 50-50 (8) | Montana: Havre, Wolf Creek |
| Walker | | |
| <i>Epinotia emarginana</i> | E-9 (1) ³ | California: Monterey |
| (Walsingham) | | |
| <i>Epinotia miscana</i> (Kear- | E-9 (3) | Oregon: Crescent Lake |
| fott) | 50-50 (1) | |
| <i>Epinotia columbia</i> (Kear- | Z-9 (4) | Idaho: Headquarters |
| fott) | E-9 (2) | Montana: East Glacier |
| | 50-50 (5) | |
| | E,E-8,10 (1) | |
| <i>Epinotia</i> n. sp. | E,E-8,10 (32) | Arizona: Kingman B |
| <i>Ancylis columbiana</i> Mc- | Z-9 (792) | California: Camino, Descanso (14 |
| Dunnough | 50-50 (70) | km NE), Emigrant Gap, Fall |
| | | River Mills (4 km NW), Julian |
| | | (3 km SW), Lake Arrowhead (3 |
| | | km NE), Monterey, Sierra City |
| | | (12 km N), Upper Lake (20 km |
| | | N) |
| | | Oregon: Bly, Ashland, Cave Jct., |
| | | Crater Lake, Crescent Lake, |
| | | Keno, Idanha, Tiller, Oakridge, |
| | | Sisters, Grants Pass, O'Brien |
| | | Washington: Goldendale, Kettle |
| | | Falls, Leavenworth |
| <i>Ancylis simuloides</i> Mc- | Z-9 (191) | California: Lake Arrowhead, Old |
| Dunnough | | Station (10 km SE) |
| <i>Ancylis alba fasciata</i> Hein- | Z-9 (7) | Oregon: Crescent Lake |
| rich | | |
| <i>Ancylis pacificana</i> (Wal- | Z-9 (6) | Oregon: Bend |
| singham) | | |
| <i>Ancylis mediofasciata</i> | E-9 (1714) | California: Big Bear City A, |
| (Clemens) | | Crestline (1 km NE), Descanso |
| | | (14 km NE), Emigrant Gap, |
| | | Fall River Mills (4 km NW), |
| | | Hat Creek, Julian (3 km SW), |
| | | June Lake (6 km E), Lake Ar- |
| | | rowhead (3 km E), Mt. Shasta |
| | | City, Old Station (10 km SE), |
| | | Placerville, Scott Valley (4 km |
| | | NW), Truckee A, Upper Lake |
| | | (20 km N) |

TABLE 1. Continued.

| Species | Attractant(s) and number moths trapped | Localities collected ¹ |
|---|--|--|
| | | <i>Colorado</i> : Ft. Collins |
| | | <i>Idaho</i> : Arco, Boise, Coeur d'Alene |
| | | <i>Montana</i> : Boulder, East Glacier, Superior, Wolf Creek |
| | | <i>Oregon</i> : Ashland, Baker, Bookings, Burns, Cave Jct., Crater Lake, Crescent Lake, Gold Beach, Grants Pass, Idanha, Keno, Lakeview, Oakridge, O'Brien, Sisters, Tiller |
| | | <i>Utah</i> : Dutch John, Manila |
| | | <i>Washington</i> : Goldendale, Kettle Falls, Okanogan, Pomeroy, Shelton |
| | | <i>Wyoming</i> : Afton, Kemmerer |
| Laspeyresiini | | |
| <i>Dichrorampha sedatana</i> (Busck) | 50-50 (6) E,E-8,10 (28) | <i>Montana</i> : Wolf Creek <i>South Dakota</i> : Deadwood |
| <i>Sereda tautana</i> (Clemens) | E,E-8,10 (89) | <i>New Mexico</i> : Ruidoso, Silver City |
| <i>Grapholita caeruleana</i> Walsingham | E,E-8,10 (44) | <i>Idaho</i> : Arco |
| <i>Grapholita conversana</i> Walsingham | E,E-8,10 (ca. 2900) | <i>Arizona</i> : Williams (20 km S) <i>California</i> : Clear Lake (20 km N), Crestline (1 km NE), Descanso (14 km NE), Emigrant Gap, Hat Creek, Julian (3 km SW), Lake Arrowhead (3 km NE), Monterey, Old Station, Sierra City (12 km N) |
| | | <i>Colorado</i> : Pagosa Springs |
| | | <i>Idaho</i> : Boise, Headquarters |
| | | <i>Montana</i> : Conner, Havre |
| | | <i>Oregon</i> : Baker, Burns, Cave Jct., Crater Lake, Keno, Lakeview, Tiller |
| | | <i>South Dakota</i> : Deadwood |
| | | <i>Utah</i> : Cedar City, Vernal |
| | | <i>Washington</i> : Entiat, Goldendale, Kettle Falls, Leavenworth, Pomeroy, Tacoma |
| | | <i>Wyoming</i> : Afton, Buffalo |
| <i>Cydia populana</i> (Busck) | E,E-8,10 (25) | <i>Colorado</i> : Redfeather Lakes <i>Utah</i> : Dutch John, Manila |
| <i>Cydia</i> n. sp. nr. <i>strobilella</i> (L.) | E,E-8,10 (13) | <i>Idaho</i> : Boise |
| <i>Cydia</i> ? <i>tana</i> (Kearfott) | 50-50 (4) | <i>Oregon</i> : Ashland |
| <i>Cydia</i> nr. <i>leucobasis</i> (Busck) | E,E-8,10 (10) | <i>Oregon</i> : Idanha |
| <i>Cydia americana</i> (Walsingham) | E,E-8,10 (61) | <i>California</i> : Julian (3 km SW), Lake Arrowhead (3 km NE) |

TABLE 1. Continued.

| Species | Attractant(s) and number moths trapped | Localities collected ¹ |
|----------------------------------|--|---|
| | | <i>Idaho</i> : Boise |
| | | <i>Oregon</i> : Burns, Eugene, Tiller |
| | | <i>Washington</i> : Entiat, Goldendale |
| <i>Cydia colorana</i> Kearfott | E,E-8,10 (13) | <i>California</i> : Lee Vining (4 km SW) |
| | | <i>Colorado</i> : Ft. Collins C |
| <i>Cydia cupressana</i> Kearfott | Z-9 (4) | <i>California</i> : Monterey |
| <i>Cydia piperana</i> complex | E-9 (62) | <i>California</i> : Old Station |
| | Z-9 (14) | <i>Oregon</i> : Sisters |
| | 50-50 (210) | <i>Montana</i> : Boulder, Conner, Havre, Wolf Creek |
| | | <i>Washington</i> : Entiat, Goldendale, Kettle Falls, Pomeroy |
| | | <i>Utah</i> : Manila, Vernal |
| | | <i>Wyoming</i> : Afton, Kemmerer |
| Tortricinae | | |
| Cnephasiini | | |
| <i>Decodes stevensi</i> Powell | Z-9 (163) | <i>Colorado</i> : Fort Collins C |

¹ See Stevens et al. (1980) for more detailed trapping locations, and trapping dates. Detailed locations given here only if not included in Stevens et al. (1980).

² E,E-8,10 only from Kingman, Ariz.

³ Probably incidental. *E. emarginana* is a generally abundant species and should have been trapped in greater numbers if moths responded to the lures.